DOCUMENT RESUME

ED 442 831 TM 031 251

AUTHOR Farrah, Shirley J.; Graham, Steven W.

TITLE Variables Influencing the Likelihood of Practice Change after Continuing Education.

PUB DATE 2000-04-26

NOTE 26p.; Paper presented at the Annual Meeting of the National Council on Measurement in Education (New Orleans, LA, April 25-27, 2000).

PUB TYPE Reports - Research (143) -- Speeches/Meeting Papers (150)

EDRS PRICE MF01/PC02 Plus Postage.

DESCRIPTORS *Behavior Change; *Continuing Education; *Nurses; *Nursing; Professional Development

ABSTRACT

This study was conducted to identify the continuing education (CE) elements nurses believed were most likely to influence their nursing practice and to examine R. Cervero's (1982) comprehensive model of continuing professional education. A total of 344 registered nurses returned questionnaires about CE. Using a researcher-developed 37-item instrument, 12 items were identified as most important in influencing change. The top three items were potential benefit to the patient, perceived value of the proposed change, and extent to which the change addressed a relevant practice problem. A unifying theme among the three items was their strong practice orientation. All four of Cervero's categories (nature of the learner, the CE program, the proposed change, and the social system) were represented in the top 12 items, with items related to the proposed change and the social system rated the highest. A principal components analysis with varimax rotation resulted in five subscales (CE Program, Difficulty in Implementing, Willing and Able, Experience and Education, and Application to Practice) and accounted for 47% of the explained variance in variables influencing the likelihood of practice change. The findings reinforce the usefulness of Cervero's notion of a multivariate framework when studying the relationship between CE and practice change. (Contains 2 tables and 38 references.) (Author/SLD)

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VARIABLES INFLUENCING THE LIKELIHOOD OF PRACTICE CHANGE AFTER CONTINUING EDUCATION

By

Shirley J. Farrah

Assistant Dean of Nursing Outreach and Distance Education

Sinclair School of Nursing

University of Missouri-Columbia

and

Steven W. Graham

Director, President's Institute for Academic Leadership – University of Missouri System and

Associate Professor, Department of Educational Leadership and Policy Analysis

University of Missouri-Columbia

Paper Presented at the

National Conference of the American Educational Research Association

New Orleans, Louisiana

April 26, 2000

Steve Graham
215 University Hall
University of Missouri System
Columbia, MO 65211
573-884-6740
grahams@umsystem.edu

TM031251

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Abstract

This study was conducted to identify the continuing education (CE) elements nurses believed were most likely to influence their nursing practice and to examine Cervero's comprehensive model of continuing professional education. Using a researcher-developed 37 item instrument, 12 items were identified as most important in influencing change. The top three items were potential benefit to the patient, perceived value of the proposed change, and extent to which the change addressed a relevant practice problem. A unifying theme among the three items was their strong practice orientation.

All four of Cervero's (1982) categories (nature of the learner, the CE program, the proposed change, and the social system) were represented in the top 12 items with items related to the proposed change and the social system rated the highest. A Principal Components Analysis (PCA) with varimax rotation resulted in five subscales (CE Program, Difficulty in Implementing, Willing and Able, Experience and Education, and Application to Practice) and accounted for 47 % of the explained variance in variables influencing the likelihood of practice change. The findings reinforce the usefulness of Cervero's (1982) notion of a multivariate framework when studying the relationship between CE and practice change.

Variables Influencing the Likelihood of Practice Change after Continuing Education

Introduction

As the largest single group of health care professionals in the United States, the potential impact of nurses on patient care is profound. Sound decision making by nurses requires a current knowledge and skill base and the ability to translate this knowledge into practice. This is a particularly challenging task as it is estimated that the half-life of professional knowledge is less than three years (Parks, Schiller, & Bryk, 1994). The literature offers mixed and conflicting empirical findings with respect to the link between continuing education (CE) and its impact on improving practice. Numerous studies involving a variety of nursing specialties ranging from community health (Cox & Baker, 1981) to emergency nursing (Hedman & Miller, 1987), and CE program topics ranging from neonatal resuscitation (Dunn, Niday, Watters, McGrath, & Alcock, 1992) to case management (Connors, 1989), all pointed to the positive impact of CE on practice. On the other hand, in spite of numerous studies documenting desired practice change after CE, several earlier studies failed to demonstrate a relationship between CE and practice-related change (del Bueno, 1977a; Dolan, 1973; Gosnell, 1979; Igmire, 1973; Oliver, 1984; Thurkettle & Benjamin, 1979). Clearly, some CE programs resulted in behavioral change while others did not.

This study was conducted to identify the continuing education elements nurses believed were most likely to influence their nursing practice and to examine the utility of Cervero's model as a comprehensive model of continuing professional education.

Review of Literature

It is well documented that CE is an effective means of disseminating new knowledge and introducing individuals to new ways of professional practice in health care arenas (DuGas, 1969; Wake & Gotch, 1985). CE effectiveness has been demonstrated with programs as short as one hour (Bernick & Richards, 1994) and as long as 160 hours (Bellack, 1995). Documented changes in practice behaviors after CE participation include diverse practice changes such as greater use of nonpharmacologic pain management techniques (Pederson, 1996), an improved

and more comprehensive approach to nursing care (Heick, 1981), improved documentation (Bernick & Richards, 1994), and improved patient education skills (Peden, Rose, & Smith, 1990). Practice change has been demonstrated not only immediately after the CE program but also up to eight months after the CE program (Heick, 1981). Moreover, practice change after CE resulted in positive patient outcomes (Foglesong, 1983; Gill & Ursic, 1994). Changes in practice-related behaviors have not only been reported by nurses themselves but also by their supervisors (Heick, 1981; Peden, Rose, & Smith, 1990), as well as through chart audits (Cox & Baker, 1981; Oliver, 1984; Rottet & Cervero, 1986).

Although the clear majority of studies demonstrated desired practice change after CE participation, a few studies failed to do so. Dolan (1973) found no significant difference between therapeutic behaviors of nurses and nurses' aides who participated in a CE program and those who did not. Other studies involving rehabilitation nursing (Gosnell, 1979), a physical assessment course for community health nurses (Oliver, 1984), and admission assessment (Thurkettle & Benjamin, 1979) found no significant differences in practice behaviors after CE programs. Similarly, del Bueno (1976, 1977a) found no change in nursing practice related to information-giving behaviors and in questioning physicians' medical orders, even though cognitive gain and increased participant satisfaction occurred. Finally, Igmire (1973) found a change in attitude that persisted for one year but found no corresponding change in behavior. For patients to benefit, cognitive and attitudinal changes alone are not sufficient. A change in practice must occur.

In an attempt to reconcile the conflicting results concerning the effects of CE on nursing practice, Waddell (1991) performed a meta-analysis of published and unpublished studies. This comprehensive study examined the extent to which Cervero's (1982) four categories (nature of the learner, the CE program, the proposed change, and the social system) mediated the effects of CE on nursing practice. Using rigorous inclusion criteria, she selected thirty-four studies to review. Most supported the hypothesis that CE had a positive effect on nursing practice, however, the findings concerning the mediating effects were inconclusive. Therefore, the question of why and how certain CE programs were more effective than others in producing

practice-related change was not answered.

The inability to consistently demonstrate a positive relationship between CE and practice change may be partially explained by the fact that most researchers have used a univariate linear model to assess the CE programs. According to Cervero (1982), this is an incomplete and overly simplistic approach. He noted that the models traditionally used to determine implementation of learning after continuing education participation were too narrow and focused almost solely on the nature of the continuing education program (e.g., duration, teaching strategies, and involvement of the learner). Cervero (1982) suggested this narrow approach overlooks three other important categories of variables, including the nature of the: a) learner (e.g., educational level, years in active nursing practice, general predisposition toward change), b) proposed change (e.g., difficulty in implementing, perceived benefit to the patient, cost), and the c) social system within which the change is implemented (e.g., visible support from others, opportunities to apply what has been learned, and an environment conducive to change). His model consists of all four categories (i.e., the nature of the CE program, the learner, the proposed change, and the social system).

Empirical testing of Cervero's (1982) model demonstrated that indeed all four categories were important in understanding the link between CE and practice, with some categories explaining more variance in practice change than others. The Cervero (1982) model explained 63% of the total variance in performance of new graduates one week after an orientation program and only slightly less, 57%, six months later. Learner and CE program variables accounted for the greatest variance both at one week and six months after the program (Cervero, 1984a; Cervero & Rottet, 1984). In a later study by Cervero, Rottet, and Dimmock (1986), learner variables (e.g., attitude toward change) again were most prominent along with the learner's intent to implement change. In other studies, Cervero's (1982) model accounted for up to 45% of the total variance after CE participation and all four categories were influential, especially the nature of the social system. Nevertheless, the results were mixed with respect to the degree of influence exerted by each category due, in part, to the difficulty in determining

which of the variables under each category affected practice change.

This study analyzes the responses of nurses currently engaged in practice to determine the elements that are most likely to result in practice change. In addition, through the use of principal component analysis, we attempted to determine if Cervero's framework for understanding continuing professional education could be empirically validated with professional nurses.

Methodology

Instrumentation

This was an exploratory study using Cervero's multivariate model (Cervero, 1982) to identify the variables influencing the likelihood of staff nurses implementing practice-related changes proposed in CE programs. The Variables Influencing the Likelihood of Practice Change Questionnaire (VILPCQ), a paper and pencil questionnaire, was developed around Cervero's four categories and included a wide range of items covering all the critical variables reported in the literature that influenced practice change. We also collected demographic and job information from the respondents.

Validity: Content representativeness and content relevance of the preliminary VILPCQ were established using the two-stage (development and judgment) process described by Lynn (1986) using 31 nursing educators and nursing staff development experts. The experts included the editors from a leading CE journal and two major nursing staff development texts and other published authors. Based on expert reviewer feedback, the revised VILPCQ included 37 items representative of all four categories suggested by Cervero (1982). The content validity index (CVI) described by Waltz and Bausell (1981) was also calculated. The CVI for the total instrument is the proportion of items judged content relevant by at least 75% (N=23) of the expert nurse reviewers. Eighty percent (25) of the 31 items on the preliminary VILPCQ were endorsed by at least 23 of the 31 nurse experts as content valid. The CVI was 0.8 indicating instrument content validity (Waltz, Strickland, & Lenz, 1991).

Reliability. Reliability of the revised VILPCQ was estimated using Cronbach's coefficient alpha procedure to determine internal consistency. This procedure provided an

estimate of the split-half correlations for every possible way of dividing the 37 items on the revised VILPCQ (Polit & Hungler, 1993). The overall VILPCQ reliability coefficient was .90, indicating a high degree of internal consistency. Reliability for the individual subscales (see below) ranged from .73-.85.

Sample: Data collection followed the Total Design Method (TDM) described by Salant and Dillman (1992) in order to maximize questionnaire response rates and minimize item non-response rates. The study population consisted of 800 randomly selected registered nurses from a Midwestern state who indicated on their license renewal application that they held hospital-based staff nurse positions. All of the registered nurses had been out of school for a minimum of three years, thus increasing the likelihood they had attended CE programs.

A total of 344 questionnaires from a possible 748 were returned (54 were dropped due to incorrect addresses) for a response rate of 46%. This return rate is lower than the 77% average response rate reported by other researchers (McLaughlin & Marascuilo, 1990) using Salant and Dillman's (1992) TDM. However, it is consistent with the 48% expected response rate posited by Craft, Heick, Richards, Murray, Lathrop, & Reed (1992). This sample size of 344 was also slightly below Nunnally's (1978) general guideline "to have at least 10 times as many subjects as variables" (p. 421) yet it was considered acceptable and sufficient to proceed with the analyses.

Data Analysis

We used two approaches to determine which of the 37 items on the VILPCQ staff nurses reported as having the greatest influence on the likelihood of implementing practice change proposed in CE programs. First, items with a mean score of 7 or greater (where 1 = no influence whatsoever and 10 = absolutely influence) and a standard deviation less than two were selected. A standard deviation of two was used to ensure a fair degree of consensus among the respondents. A second approach was to ask the subjects to identify the top three items that exerted the greatest influence on the likelihood of changing their practice after CE participation. Responses for each item were weighted (most important item = 10 points, second most important item = 9 points, and third most important item = 8 points, etc.) and then summed across the top three items for the total sample.

To address the issue of whether or not the empirical component structure of the VILPCQ logically fit with Cervero's (1982) four category model we used an Exploratory Principle Components Analysis (PCA). PCA was used "to arrive at a relatively small number of components that will extract most of the variance of a relatively large set of . . . items" (Pedhazur & Schmelkin, 1991, p. 598). Following Pedhazur and Schmelkin's (1991) suggestion, both orthogonal (varimax) and oblique (direct oblimen) rotations were performed to determine the best interpretability. Items failing to achieve loadings of .40 or above on any component were eliminated. A minimum Eigenvalue of 1 was required for components to be retained and a scree test was used to further verify the number of components to retain (Kim & Mueller, 1978; Nunnally, 1978). A minimum number of items (i.e. 3-5) loading on each component was required for the component to be interpreted (Kim & Mueller, 1978; Pedhazur & Schmelkin, 1991).

Component-based subscales resulting from the PCA were derived by summing the scores of the items comprising each component (Pedhazur & Schmelkin, 1991) and dividing by the number of respondents to arrive at a mean subscale score. Due to different numbers of items comprising the various components, a weighted mean subscale score was obtained for each of the components by dividing the mean subscale score by the number of items loading on that component. Throughout the remaining presentation, "subscale scores" will be used to denote "weighted mean subscale scores" and the term "component" will be used in lieu of "factor", since PCA rather than factor analysis, per se, was the statistical procedure (Pedhazur & Schmelkin, 1991).

Results

The average age of the sample was 47.8 years and over 70 % of the respondents were between the ages of 35-54. Considering that most registered nurses enter the field at the staff nurse level immediately after graduation, this group of nurses appeared to be relatively old, even accounting for the fact that they had all been out of school for at least three years. However, this finding was consistent with the Division of Nursing's (1996) report that the average age of RNs in the United States is 44 years of age. Further, the relatively old sample mirrors the average of 48.6 years of age for all hospital-based RNs in the Midwestern state who have been out of school for three years (Personal communication, State Department of Health, Bureau of Health

Resources Statistics, September 28, 1998).

The majority of the sample held the diploma or ADN as their highest educational credential and worked in community (versus teaching) hospitals. Consistent with their age, they had been in active nursing practice a relatively long time, nearly 24 years. They were an active group of CE attendees, accumulating an average of 28.3 hours of CE during the past year, equivalent to about four days.

With respect to the issue of which of the 37 items on the VILPCQ had the greatest influence on the likelihood of implementing practice change proposed in CE programs, the respondents assigned the full range of scores (i.e., 1 - 10) for all but one of the 37 items. The mean score for all respondents on all 37 items was 7.13 (ranging from 9.02 - 4.06) and the mean standard deviation was 2.3. A complete list of the 37 items from the VILPCQ with their means and standard deviations, along with the Cervero (1982) category represented by each category appears in Table 1. The highest means were generally associated with the lowest standard deviations indicating more consistent agreement on the items exerting the greatest influence on practice change.

Using the mean score of seven or greater and a standard deviation less than two to identify those aspects most likely to influence practice change, 12 items emerged. The top 12 items and their original Cervero classification (i.e., nature of the learner, nature of the CE program, nature of the proposed change, nature of the social system) appear in Table 1. It is important to note that items from all four of Cervero's (1982) categories were included in the top 12 items, although variables related to the nature of the proposed change were predominant. To illustrate, the top three items were all from the nature of the proposed change category and the unifying theme was their highly clinical and strong practice orientation. In descending order, the number and proportion of items from each of Cervero 's categories appearing among the top 12 were (a) nature of the proposed change items -- 5 out of 11, (b) nature of the social system -- 3 out of 9, (c) nature of the CE program -- 3 out of 11, and (d) nature of the learner -- 1 out of 6. See Table 1.

The second approach to identifying the most influential variables included an analysis of

the responses to the question asking the subjects to identify the top three VILPCQ items exerting the greatest influence on practice change after CE participation. The top three items using this approach were identical to those using the first approach (i.e., potential benefit to patient, how strongly you value the proposed change, and change addresses a relevant practice problem). This provided confirmatory evidence concerning the three most influential variables with respect to practice change and their strong link to clinical practice.

Addressing the issue of whether or not the empirical structure of the VILPCQ logically fits with Cervero's (1982) four-category model, the PCA was employed. Using exploratory PCA as the extraction method, nine components emerged with Eigenvalues greater than 1, explaining 59% of the variance. After varimax rotation, there were high loadings for some of the 37 variables from the VILPCQ on certain components (i.e., subscales) and either no or low loadings on all others.

Using .4 as the cut-off point for meaningful component loadings (Pedhazur & Schmelkin, 1991), almost all of the variables loaded on one and only one component. The two variables that loaded on more than one component were assigned to the component with the highest loading. The scree plot suggested five components could be used and a total of 26 items loaded on the five components and explained 47% of the variance. The five components and the variables loading on each of them, along with the original classification according to Cervero's (1982) categories, appear in Table 3. The number of items loading on each component meets the suggested minimum (i.e., 3-5) for the component to be adequately interpreted (Kim & Mueller, 1987; Pedhazur & Schmelkin, 1991).

Nine items loaded on the first component entitled *CE Program*, accounting for 24% of the variance, which is over half of the total amount of explained variance. Each of the items was clearly related to Cervero's (1982) nature of the CE program category. This component included items such as the extent to which the program used CE faculty who involved the learners, used a variety of teaching/learning activities, had knowledgeable and credible CE faculty, and allowed time to practice the proposed change.

Four items loaded on the second component labeled *Difficulty in Implementing*,

accounting for another 7% of the variance on the VILPCQ. These items related to the overall difficulty of implementing the change, the time and effort required, and the resulting disruption and interference in the nurse's usual practice. This component may be viewed as the "hassle index" associated with implementing a change in practice – or Cervero's nature of the proposed change category.

A third component, *Willing and Able*, consisted of five items related to the nurse's psychological readiness (willingness to implement the proposed change) and job-related readiness (ability to implement the proposed change). This component added another 7% of the explained variance. Two of the four items (confident in ability to perform proposed change, and personal level of motivation to attend CE programs) were directly related to internal characteristics of the nurse learner (i.e., confidence and motivation). Two more items (supervisor's openness to proposed change, and visible support and encouragement from peers, patients, physicians) had an external orientation, while the fifth item (acceptability of proposed change to you and others) had both an internal and external focus. *Willing and Able* was more difficult to relate directly to one of Cervero's (1982) four categories.

A fourth component, *Experience and Education*, consisted of three items and accounted for another 5% of the explained variance. All three items (years in current position, years of nursing practice, and level of formal education) were directly related to Cervero's (1982) nature of the learner category and originally were categorized as such.

Finally, *Application to Practice*, consisted of five items and accounted for another 4% of the variance. It is interesting to note that two of the top three items identified as having the greatest influence on the likelihood of practice change, (how strongly you value the proposed change and change addresses a relevant practice problem), appeared in this component. This was to be expected, given the strong clinical orientation of the top three items. Like *Difficulty* in *Implementing*, the *Application to Practice* component was closely related to Cervero's (1982) nature of the proposed change category.

Because there were fairly high correlations (0.3 and above) between some of the components, a direct oblimen rotation also was employed to determine the best method of

interpreting the components (Pedhazur & Schmelkin, 1991). In general, the results from direct oblimen rotation were similar to those obtained by varimax rotation. As with the varimax rotation, the scree plot for the direct oblimen suggested that five components be used. Three of the five components appearing in the varimax rotation appeared as the first three components of the direct oblimen rotation (*CE Program, Experience and Education*, and *Difficulty in Implementing*). However, two components tentatively labeled "Benefit to Patient and Organizational Fit" and "Competing Demands" completed the list. These two new components were more difficult to interpret than the components emerging from the varimax rotation; therefore varimax was selected as the rotation of choice. Even so, the amount of variance attributed to the various constructs did not change more than 3%, regardless of whether varimax or direct oblimen was used.

The weighted mean scores for the five subscales (i.e., components) resulting from varimax rotation appear in Table 3. They are based on the sum of all the items loading above .40 on each individual component (Pedhazur & Schmelkin, 1991). The highest weighted mean subscale score was for the *Application to Practice* component, indicating the power and influence of this component on practice change. The lowest weighted mean subscale score was associated with *Experience and Education*.

Summary and Conclusions

In summary, the VILPCQ did a fairly good job of capturing the full range of variables influencing practice change after CE participation. The top rated item, potential benefit to the patient, was the nurses' primary consideration of whether or not they would adopt a practice change. A general theme among the top 12 items was a strong link to practice and application in the clinical arena. Although all four of Cervero's (1982) categories were represented in the top 12, the nature of the proposed change and the nature of the social system variables were more dominant than were the nature of the CE program and the nature of the learner variables. This theme was also consistent with the opinions of the expert review panel who critiqued the VILPCQ during its development. Even though the VILPCQ items related to the CE program and learner categories were among the most objective and straightforward, they were not as

influential in the nurses' attitudes about the likelihood of behavior change. This particular finding is consistent with Cervero's (1982) thesis that too much emphasis has been placed on the CE program at the expense of the other categories of variables. Further, most CE effectiveness studies typically focus on the CE program and learner categories when examining the effects of training.

Examining the twelve items that were rated as the most important considerations when adopting practice change allows some important conclusions to be drawn. First, for CE programs to be effective in promoting change they must focus on valued practices that benefit the patient, address a relevant practice problem, and make professional duties easier to accomplish. In addition, the proposed practice change must be obtainable, supported in the environment by colleagues and superiors, and consistent with the values and culture of the organization. These findings support the extensive research of Rogers (1983) as well as the practices seen as most valued in training (Graham, Wedman, Monahan & Tanner, 1998). Clearly one conclusion is that more attention should be given to offering practical, doable techniques that address current problems of professional practice when designing the content of CE programs.

Consistent with Pedhazur and Schmelkin's (1991) admonition that exploratory factor analysis should only be used in the presence of an accompanying theoretical rationale, we found the empirical component structure of the VILPCQ can be used to validate the constructs of Cervero's (1982) multivariate model. The findings provide qualified support for the model in that there were meaningful loadings on the rotated component matrix for variables related to all four of Cervero's (1982) categories. The PCA results, along with the high coefficient alphas for the five VILPCQ subscales, offer preliminary evidence that the VILPCQ may be a reliable tool to measure likelihood of practice change after CE participation.

The *CE Program* component was clearly related to Cervero's (1982) nature of the CE program category. The items loading on this component were very straightforward and were easily classified into the *CE Program* category. The variance accounted for by the *CE Program* subscale far exceeded that of any of the other components. At first glance, this finding may

appear to be inconsistent with the above findings where items related to the CE program category were relatively less influential in promoting practice change than the other Cervero categories such as the nature of the proposed change and the social system. However, it is indeed possible for nurses to assign relatively lower ratings to the nine CE program-related items on the VILPCQ (i.e., the items did not have much influence on practice change) and, and the same time, have those same nine items easily load on one component. Because the nine CE program-related items were objective, discrete, and clearly related to one and only one component, they loaded easily on the *CE Program* component.

Furthermore, this study specifically focused on practice change after CE participation. If the VILPCQ had addressed variables influencing practice change that was not necessarily introduced in a CE program, proportionately more influence might shift the other categories related to the nature of the learner, the nature of the proposed change, and the nature of the social system. It is the component loading that accounts for the high proportion of variance attributed to the CE Program component. The relatively low weighted mean subscale score for the *CE Program* component is due to the low influence ratings assigned to the nine items.

The second component, *Difficulty in Implementing*, was clearly related to Cervero's (1982) nature of the proposed change category. Most items loading on *Difficulty in Implementing* were unambiguous and were fairly easily classified under the nature of the proposed change category. The importance of considering the overall level of difficulty in implementing any change in practice (i.e., hassle index) is also consistent with the work of Horsley and associates (Horsley, Crane, Crabtee & Wood, 1982).

The *Experience and Education* component was clearly related to Cervero's nature of the learner category and the items comprising this subscale were easily labeled. Like items in the *CE Program* component, the items related to the nurses' experience and education were discrete variables without apparent overlap with Cervero's other categories and clustered neatly into this one component. Whereas this learner-oriented category explained only 5% of the variance in the current study, Cervero and colleagues found that the nature of the learner category explained up to 27% of the variance; equal to the amount of variance explained by the *CE Program*

component in this study (Cervero, 1984a; Cervero & Rottet, 1984; Cervero, Rottet, & Dimmock, 1986). Perhaps this can best be explained by the fact that different learner variables were used in each of the studies or that this study specifically asked participants about changes related to CE program and participation.

Although the *Willing and Able* component was related to three different Cervero (1982) categories (i.e., the nature of the learner, the nature of the proposed change, and the nature of the social system), it was not a particularly difficult component to interpret and label in this study. All items in this subscale were directly related to the nurse's readiness to implement the proposed change. Both psychological readiness (willingness) and job-related readiness (ability) were important influences and there was an apparent relationship between the two. In actual practice, it is well recognized that internal factors such as one's motivation to change and confidence in one's ability to do so, along with external factors such as encouragement and support from those whose opinions matter, are interwoven. Perhaps the interaction of both internal and external factors influences is best articulated by the VILPCQ item "acceptability of the proposed change to you and others", another item appearing on the *Willing and Able* subscale.

Application to Practice was primarily related to Cervero's nature of the proposed change category, although items from the nature of the program and the nature of the social system categories also loaded on this subscale. Similar to *Willing and Able*, which included items from several categories, this component was not especially difficult to interpret and label. The *Application to Practice* component may cover a broader concept than either the *CE Program* or *Experience and Education* component. Therefore, it is likely influenced by a number of interacting variables that might explain the overlapping nature of items found in this component.

These last two components, *Application to Practice* and *Willing and Able*, achieved the highest weighted mean subscale scores derived from the VILPCQ, thus indicating their greater influence on the likelihood of practice change. This is partially due to the fact that both of these components included items related to Cervero's nature of the proposed change and nature of the social system categories, which achieved higher overall ratings than either the nature of the

learner or nature of the program category variables in this study. Indeed, two-thirds of the items from the top 12 were related to Cervero's nature of the proposed change and nature of the social system categories. Conversely, the *Experience and Education* component had the lowest mean subscale score due to the low ratings assigned to the items comprising it, all of which were from Cervero's nature of the learner category.

The results from this research support Cervero's (1982) original notion that all four categories of variables are important with respect to practice change following CE participation. However, four distinct components that directly matched his model did not emerge in this study. This may be due, in part, to the fact that in some cases a single item overlapped two or more categories. One approach that might increase the value of Cervero's (1982) model in describing the behavior of this group of professionals would be to reword overlapping items such that they would clearly fit under one and only one of his categories. However, this is difficult to do and is further complicated by the idiosyncratic perceptions individuals bring when reading, interpreting, and responding to the VILPCQ items. Certainly, in actual practice, the variables influencing behavior change do interact and overlap with one another. No doubt there are interrelationships among what the nurses think, feel, and believe about practice change (nature of the learner), the overall difficulty in implementing practice change (nature of the proposed change), the social culture of the clinical arena in which the nurse functions (nature of the social system). Therefore, a more reasonable and helpful approach might be to continue with the approach used in this study, where the focus was less on categorizing the items into discrete subsets and more on assuring that the items represented all four of Cervero's (1982) categories and sufficiently covered the practice change domain. This approach, used with other professional groups, might also result in further refinement of Cervero's (1982) model and allow it to be tailored to address various professions.

There are limitations in this study that should be noted. First, the sample size of 344 was slightly below that recommended for analysis of the 37 item VILPCQ due to the difficulty of missing addresses and busy nurses who did not respond. Second, the sample was limited to only hospital-based staff nurses in one state and may not represent nurses working in other settings or

in other states. Lastly, while the VILPCQ was developed carefully with the advice of experts and has high reliability ratings, it is a new instrument and some of the items actually represented more than one of Cervero's general themes.

Although the study provided insight into the research questions addressed in this research, there are several additional recommendations for further study. First, the study could be replicated with nurses from other practice settings to determine if the components that influence hospital-based nurses' practice change after CE participation hold across different settings. Cross-cultural replication also would be interesting to determine the similarity of responses across cultures. As suggested by some of the respondents, items related to financial cost, outcomes-based content addressing the need for the practice change, accessible and affordable CE programs, and follow-up by unit staff or CE faculty after the program could be added to the VILPCQ. Further, a qualitative study could be conducted to further elucidate the link between CE and practice change by asking nurses to identify specific instances when their practice was affected by CE participation. Such an approach, grounded in the data from individual cases, might address the "why and how" dimensions of practice change that are missing in the present study. Last, although self-reports of "intent to change" are valid predictors of actual behavioral change (Ajzen & Fishbein, 1980), an investigation of actual practice change would be helpful.

This study helps inform practice by considering a comprehensive set of items to determine those aspects that are most likely to affect practice. First, examining how those items influenced the participants' desires to change practice (e.g., valued changes that address relevant problems and benefit patients) as well as those seen as less important (e.g., years in practice, nursing experience, educational background) can specifically enhance CE programs for professionals. These elements can easily incorporated into program design efforts. Second, the comprehensive nature of this study helped identify variables that influenced behavior change after CE participation and also offered evidence that Cervero's (1982) four-factor model did a fairly good job of encompassing the variables leading to behavior change. Third, in the past very little has been known about the process of transferring knowledge to nursing practice and how

nurses decide what to apply to practice (Warmuth, 1987). This study then becomes a beginning step toward clarifying the complex relationship between CE (learning) and performance (application), and the nature of the moderating variables. Last, examining those elements that are most powerful in influencing practice-related changes presented in CE programs can result in improved program planning and more successful CE programs -- with a greater likelihood of changing nursing practice and improving patient outcomes. This is critical in today's climate where both knowledge and practice change are necessary for practice improvements in any number of professional settings.

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Table 1
Mean, Standard Deviation, and Cervero (1982) for the VILPCQ Items+

VILPCQ Item and Number	Mean	SD	Category
2. Proposed change potentially benefits the patient	9.02	1.47	NPC
24. How strongly you value the proposed change	8.85	1.45	NPC
16. Change addresses a relevant practice problem	8.49	1.60	NPC
19. Applicability of CNE program to immediate practice needs	8.31	1.72	CNE
18. Proposed change makes work easier for you and others	8.09	1.95	NPC
30. Knowledgeable and credible CNE faculty	8.08	1.89	CNE
34. Confident in ability to perform proposed change	8.08	1.87	L
33. Acceptability of proposed change to you and others	7.99	1.89	NPC
35. Supervisor's openness to proposed change	7.98	2.19	SS
17. Visible support from peers, patients, and physicians	7.86	1.92	SS
14. Opportunities in work place to implement change	7.77	1.81	SS
28. Relationship between change proposed in CNE program, Organizational values, and expected practice	7.75	1.84	SS*
5. Organizational system that supports the proposed change	7.68	2.12	SS
23. Workload allows necessary time to implement change	7.65	2.05	SS**
27. Extent to which all benefits outweigh all difficulties in Implementing the proposed change	7.63	2.14	NPC
10. Extent to which benefits derived from change is visible	7.59	2.10	NPC
25. Time to discuss practical ways to implement proposed change	7.47	1.95	CNE
26. Respectful, supportive learning environment	7.46	2.10	CNE
32. Personal level of motivation to attend CNE program	7.31	2.42	L
11. Your general predisposition toward practice change	7.29	2.09	L
9. Number and extent of changes simultaneously taking place	7.25	2.28	SS
22. Overall level of difficulty in implementing proposed change	7.21	2.13	NPC
31. Learner's involvement in teaching/learning process	6.95	2.17	CNE
12. Clear relationship among objectives, content, strategies, Length	6.92	2.46	CNE
21. Change disrupts the way nursing is generally practiced	6.82	2.25	NPC
7. Learners' involvement in program planning process	6.75	2.44	CNE
1. Effectiveness of CNE faculty member as a presenter	6.63	2.44	CNE
6. Change can be implemented one step at a time	6.45	2.38	NPC
20. Degree of personal effort required to implement change	6.40	2.40	NPC
36. Faculty uses a variety of teaching/learning activities	6.35	2.36	CNE
37. Reward system, which supports and reinforces change	6.24	2.53	SS
4, CNE program includes time to practice and receive feedback	6.10	2.40	CNE
29. Learners share relevant past experiences	5.59	2.42	CNE
13. Years of nursing practice	5.30	2.82	L
15. Years in current position	5.12	2.82	L
8. Level of formal education	4.87	2.87	L
3. Whether other nurses from setting attend same CNE program	4.06	2.89	SS

NPC=Nature of the Proposed Change, CNE=CNE Program, L=Learner, SS=Social System
+ Listed in descending order of mean scores; *Competing Cervero classifications: CNE,NPC;
**Competing Cervero classification: NPC

Table 2
Principal Component Analysis and Loadings for VILPCQ and Original Cervero Classification for Items

Loading	Outcome Scales	Original Classification
CNE Program (24% of explained variance; N=340; Eigenvalue=8.8; Cronbach=. 85)		
.77	Learner's involvement in teaching/learning process	CNE
.67	Faculty use a variety of teaching/learning activities	CNE
.67	Learners share relevant past experiences	CNE
.66	Time to practice proposed change and receive feedback	CNE
.66	respectful, supportive learning environment	CNE
.66	Time to discuss practical ways to implement change	CNE
.58	Knowledgeable and credible CNE staff	CNE
.53	Clear relationship among objectives, content, strategies, length	CNE
.49	Learners involvement in CNE program planning	CNE
Difficulty in Implementing (7% of explained variance; N=339; Eigenvalue=2.7; Cronbach=.79)		
.83	Overall level of difficulty in implementing proposed change	NPC
.82	Change disrupts the way nursing is generally practiced	NPC
.74	Workload allows necessary time to implement proposed change	SS*
.54	Degree of personal effort required to implement proposed change	NPC
Willing and Able (7% of explained variance; N=339; Eigenvalue=2.4; Cronbach=.73)		
.73	Confident in ability to perform proposed change	L
.67	Acceptability of proposed change to you and others	NPC
.63	Supervisor's openness to proposed change	SS
.53	Personal level of motivation to attend CNE programs	L
.44	Visible support and encouragement from peers, patients, physicians	SS
Experience and Education (5% of explained variance; N=324; Eigenvalue=1.9; Cronbach=.74)		
.80	Years in current position	L
.77	Years of nursing practice	L
.70	Level of formal education	L
Application to Practice (4% of explained variance; N=341; Eigenvalue=1.5; Cronbach=.74)		
.70	Change addresses a relevant practice problem	NPC
.70	Opportunities in work place to implement change	SS
.54	How strongly you value the proposed change	NPC
.48	Applicability of CNE program to immediate practice needs	CNE
.42	Relationship between change proposed in CNE program, organizational values, and expected practice	SS**

CNE=CNE Program, NPC=Nature of Proposed Change, SS=Social System, L=Learner
* Competing classification: NPC ** Competing classifications: CNE, NPC

Table 3
Weighted Mean Subscale Scores for VILPCQ Components

Subscales	N	Mean	Std. Dev.	Min	Max
CNE Program (9 items)	343	6.85	1.53	1.78	10
Difficulty in Implementing (4 items)	341	7.02	1.74	1.00	10
Willing & Able (5 items)	342	7.85	1.44	1.20	10
Experience & Education (3 items)	343	5.11	2.23	1.00	10
Application to Practice (5 items)	342	8.23	1.18	3.60	10